The invention claimed is:

1. A liquid composition of matter suitable for use as a dry-in-place phosphating composition for galvanized steel, said composition comprising water and the following dissolved components:

- a concentration of from about 1.0 to about 400 g/l of phosphate ions, measured as their stoichiometric equivalent as orthophosphoric acid;
- a concentration, in g/l, of zinc cations that has a ratio to said concentration of phosphate ions, measured as their stoichiometric equivalent as orthophosphoric acid, that is from about 0.003:1.0 to about 0.10:1.00; and
- at least one adhesion-promoting substance selected from the group consisting of
  - (i) film-forming organic substances,
  - (ii) amino-phenolic polymers, and
  - (iii) inorganic oxides of one of the elements silicon, aluminum, titanium, and zirconium.

2. A liquid composition according to claim 1, wherein said adhesion-promoting substance is selected from the group consisting of:

- a concentration, in g/l, of polymers of monomers selected from the group consisting of acrylic and methacrylic acids and salts, amides, esters, and nitriles of acrylic and methacrylic acids, that has a ratio to said concentration of phosphate ions, measured as their stoichiometric equivalent as orthophosphoric acid in g/l, that is from about 0.10:1.0 to about 3.0:1.00;
- a concentration, in g/l, of amino-phenolic polymers that has a ratio to said concentration of phosphate ions, measured as their stoichiometric equivalent as orthophosphoric acid in g/l, that is from about 0.10:1.00 to about 3.0:1.00; and
- a concentration, in g/l, of dispersed colloidal oxides of at least one of silicon, aluminum, titanium, and zirconium that has a ratio to said concentration of phosphate ions, measured as their stoichiometric equivalent as orthophosphoric acid in g/l, that is from about 0.011:1.00 to about 0.70:1.00.

3. A liquid composition according to claim 2, additionally comprising:

- a concentration of manganese cations in g/l that has a ratio to the concentration of phosphate ions, measured as their stoichiometric equivalent in g/l as orthophosphoric acid, in the liquid composition that is from about 0.030:1.00 to about 0.3:1.00;
- a concentration of nickel cations in g/l that has a ratio to the concentration of

phosphate ions, measured as their stoichiometric equivalent in g/l as orthophosphoric acid in the liquid composition, that is from about 0.007:1.00 to about 0.070:1.00; and

- at least one of:
  - (i) a source of hydroxylamine with a stoichiometric equivalent as hydroxylamine that has a ratio to the concentration of phosphate ions, measured as their stoichiometric equivalent as orthophosphoric acid, in the liquid composition, both of these concentrations being measured in g/l, that is from about 0.0030:1.00 to about 0.03:1.00; and
  - (ii) iron cations in a concentration that has a ratio to the concentration of phosphate ions, measured as their stoichiometric equivalent as orthophosphoric acid, in the liquid composition, both of these concentrations being measured in g/l, that is from about 0.0007:1.00 to about 0.010:1.00.

4. A liquid composition according to claim 3, wherein:

- there is a concentration of calcium cations that has a ratio to the concentration of phosphate ions, measured as their stoichiometric equivalent as orthophosphoric acid, in the liquid composition, both of these concentrations being measured in g/l, that is from about 0.030:1.00 to about 0.080:1.00;
- there is a concentration in g/l of amino-phenolic polymers that has a ratio to the phosphate ions concentration, measured in g/l as its stoichiometric equivalent of orthophosphoric acid, in the liquid composition that is from about 0.0020:1.0 to about 0.020:1.00;
- the concentration in g/l of zinc cations has a ratio to said concentration of phosphate ions, measured in g/l as their stoichiometric equivalent as orthophosphoric acid in the liquid composition, that is from about 0.005:1.0 to about 0.035:1.00;
- the concentration of manganese cations in g/l has a ratio to the concentration of phosphate ions, measured as their stoichiometric equivalent in g/l as orthophosphoric acid, in the liquid composition that is from about 0.050:1.00 to about 0.15:1.00;
- the concentration of nickel cations in g/l has a ratio to the concentration of phosphate ions, measured as their stoichiometric equivalent in g/l as orthophosphoric acid in the liquid composition, that is at least about 0.020:1.00; and
- said amino-phenolic polymers have all of the following characteristics:

-- if all of the substituents on the aromatic rings that are substituted aminomethyl moieties and all of the substituents on the oxygen atoms bonded directly to the aromatic rings were replaced by hydrogen, the resulting polymer would be a polymer of a vinyl phenol with a weight average molecular weight that is from about 300 to about 10,000;

-- the nitrogen atoms in the substituted aminomethyl substituents on aromatic rings of the polymer molecules are bonded to three distinct carbon atoms each and are not amine oxides;

-- at least one of the moieties bonded to each nitrogen atom in the substituted aminomethyl substituents on the aromatic rings is a hydroxyalkyl moiety with from 2 to 6 carbon atoms; and

-- at least one of the moieties bonded to each nitrogen atom in the substituted aminomethyl substituents on the aromatic rings is an unsubstituted alkyl moiety having not more than 3 carbon atoms.

5. A liquid composition according to claim 3, wherein:

- there is a concentration in g/l of acrylic polymers that has a ratio to the phosphate ions concentration, measured in g/l as its stoichiometric equivalent of orthophosphoric acid, in the liquid composition that is from about 0.0020:1.0 to about 0.020:1.00;
- the concentration in g/l of zinc cations has a ratio to said concentration of phosphate ions, measured in g/l as their stoichiometric equivalent as orthophosphoric acid in the liquid composition, that is from about 0.015:1.0 to about 0.06:1.00;
- the concentration of manganese cations in g/l has a ratio to the concentration of phosphate ions, measured as their stoichiometric equivalent in g/l as orthophosphoric acid, in the liquid composition that is from about 0.050:1.00 to about 0.15:1.00;
- the concentration of nickel cations in g/l has a ratio to the concentration of phosphate ions, measured as their stoichiometric equivalent in g/l as orthophosphoric acid in the liquid composition, that is at least about 0.020:1.00; and
- said acrylic polymers have all of the following characteristics:
  -- when isolated from other materials, the acrylic polymers are a solid at 30 °C and normal atmospheric pressure;
  -- the acrylic polymers can be dissolved or stably dispersed in water to form a homogeneous solution in which the acrylic polymers constitute at least

5 % of the homogeneous solution;

-- when a homogeneous solution of the acrylic polymers in water that contains at least 0.10 cubic centimeters volume of the isolated acrylic polymers are dried at a temperature of 30 °C in a walled container with a base area of 1.0 square centimeter and walls perpendicular to the base, there is formed in the base of said container a continuous solid article of the acrylic polymers, said continuous solid article, after being separated from the container in which it was formed by drying, having sufficient cohesion to sustain its integrity against the force of natural gravity of the Earth; and

-- has a T_{300} value that is from about 15 to about 50 °C.

6. A process for providing a conversion coating on a metal substrate and adhering paint thereto, said process comprising operations of:

(I) forming over a surface of the metal substrate a liquid layer of a composition according to claim 5;

(II) without any intermediate rinsing, drying into place on the surface coated in operation (I) all non-volatile constituents of the liquid layer formed in operation (I), so as to form a dried phosphate conversion coating over the surface over which a liquid layer was formed in operation (I); and

(III) painting said dried phosphate conversion coating.

7. A process according to claim 6, wherein:

- operation (I) is performed at a temperature within a range from 20 to 30 °C; and
- during operation (II), the metal substrate achieves a peak temperature that is not more than 180 °C.

8. A process according to claim 6, wherein the dried phosphate conversion coating formed at the end of operation (II) has an add-on mass from about 0.20 to about 1.00 g/m^2.

9. A process for providing a conversion coating on a metal substrate and adhering an elastomer thereto, said process comprising operations of:

(I) forming over a surface of the metal substrate a liquid layer of a composition according to claim 4;

(II) without any intermediate rinsing, drying into place on the surface coated in operation (I) all non-volatile constituents of the liquid layer formed in operation (I), so as to form a dried phosphate conversion coating over the surface over which a liquid layer was formed in operation (I); and

(III) adhering said elastomer to said dried phosphate conversion coating.

10. A process according to claim 9, wherein:

- operation (I) is performed at a temperature within a range from 20 to 30 °C; and
- during operation (II), the metal substrate achieves a peak temperature that is not more than 105 °C.

11. A process according to claim 10, wherein the dried phosphate conversion coating formed at the end of operation (II) has an add-on mass from about 0.45 to about 2.0 g/m^2.

12. A process for providing a conversion coating on a metal substrate, said process comprising operations of:

(I) forming over a surface of the metal substrate a liquid layer of a composition according to claim 3; and

(II) without any intermediate rinsing, drying into place on the surface coated in operation (I) all non-volatile constituents of the liquid layer formed in operation (I), so as to form a dried phosphate conversion coating over the surface over which a liquid layer was formed in operation (I).

13. A process according to claim 12, wherein:

- operation (I) is performed at a temperature within a range from 20 to 30 °C; and
- during operation (II), the metal substrate achieves a peak temperature that is not more than 230 °C.

14. A process according to claim 12, wherein the dried phosphate conversion coating formed at the end of operation (II) has an add-on mass from about 0.05 to about 8 g/m^2.

15. A process for providing a conversion coating on a metal substrate, said process comprising operations of:

(I) forming over a surface of the metal substrate a liquid layer of a composition according to claim 2; and

(II) without any intermediate rinsing, drying into place on the surface coated in operation (I) all non-volatile constituents of the liquid layer formed in operation (I), so as to form a dried phosphate conversion coating over the surface over which a liquid layer was formed in operation (I).

16. A process according to claim 15, wherein:

- operation (I) is performed at a temperature within a range from 20 to 30 °C; and
- during operation (II), the metal substrate achieves a peak temperature that is not more than 230 °C.

17. A process according to claim 15, wherein the dried phosphate conversion coating formed at the end of operation (II) has an add-on mass from about 0.05 to about 8 g/m^2.

18. A process for providing a conversion coating on a metal substrate, said process comprising operations of:

(I) forming over a surface of the metal substrate a liquid layer of a composition according to claim 1; and

(II) without any intermediate rinsing, drying into place on the surface coated in operation (I) all non-volatile constituents of the liquid layer formed in operation (I), so as to form a dried phosphate conversion coating over the surface over which a liquid layer was formed in operation (I).

19. A process according to claim 18, wherein:

- operation (I) is performed at a temperature within a range from 20 to 30 °C; and
- during operation (II), the metal substrate achieves a peak temperature that is not more than 230 °C.

20. A process according to claim 18, wherein the dried phosphate conversion coating formed at the end of operation (II) has an add-on mass from about 0.05 to about 8 g/m^2.